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of the bisection of the chords which join the position of the two points, and find the polar subtangent of the curve."

The curve lies in a contrary direction to the figure in this article, and the pole is at C. $CA=2CB$; therefore the curve is not identical with ours.

The equation of the Cardioid is $r=a(1+\cos\theta)$. Write the Prunoid thus, $a\dfrac{m+\cos\theta}{m^2+1}$. Let $m=1$ and $a=2a'$; then $a\dfrac{m+\cos\theta}{m^2+1}=a'(1+\cos\theta)$. As its name indicates, the Cardioid is shaped like a heart.

NOTE BY E. L. DE FOREST.—SINCE the paper concluded at page 9 has been in the printer's hands, I have found that the theorems there given relative to the lever arm and the radius of gyration, are comprehended under two more general ones which may be briefly stated as follows.

If any number of polynomials are multiplied together, the lever arm of the coefficients in the product, about the first one as a fulcrum, is equal to the sum of the lever arms in all the factors; and the square of the radius of gyration in the product, about the centre of parallel forces as an axis, is equal to the sum of the squares of the radii of gyration in all the factors. Proof of these and some other properties must be reserved for a future article.

A correction should be made in the sentence at middle of page 8, which is so worded as to be not strictly true nor consistent with what had been said before.

The centre of parallel forces does not precisely "coincide" with the greatest coefficient unless the rank qm of that centre is a whole number. In all other cases, their positions differ by a fraction of the interval Δx. When this difference exists, the quadratic mean error ε is to be obtained by reckoning the distances of the terms from the centre of forces, and not from the greatest term. The difference vanishes when m is infinite and Δx becomes dx.

EXTENSION OF THF METHOD OF LEAST SQUARES TO ANY NUMBER OF VARIABLES.

BY R. J. ADCOCK, ROSEVILLE, ILL.

ANY point, line or surface is in its most probable position when the sum of the squares of the normals upon it, from the given points, is a minimum (ANALYST, Vol. IV, p. 184). That is, the most probable position requires that the sum of the squares of the errors of the coordinates, or variables measured, shall be a minimum. And since the law of errors in all observations is the same, which law is given by the equation

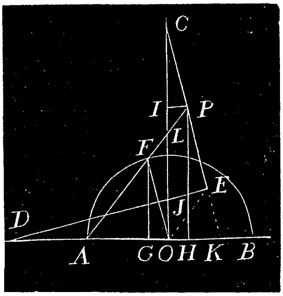
$$y = \frac{p}{1 + cx^2},$$

(ANALYST, p. 51 Vol. V), where y is the probability of the error of magnitude x; therefore, universally, when the constants in an equation or equations, of any number of variables, are to be determined from measured values of the variables, they must be determined by the condition that the sum of the squares of the errors of these measured values shall be a minimum.

DEMONSTRATION OF THE CISSOID.

BY JAMES SIMMONS, JR., BELOIT, WIS.

THE following construction is founded on the definition of the Cissoid given in Olney's General Geometry and Calculus. CO is the fixed line, D the fixed point, CED the right angle, whose side $CE = DO$. Required to find the locus of its middle point P.



With a center O, and radius CP describe the semicircle. Join O and E, O and F, A and P Draw PH and FG parallel to CO; PI to BD, and produce CE to K.

Since CEJ and DOJ are equal right angles $JE = JO$, and the triangle OJE is isosceles; $\therefore$ $JEO = JOE$; $\therefore$ $PEO = DOE$; $\therefore$ $OEK = EOK$, and the triangle OKE is isosceles.

But $PE = AO$; $\therefore$ triangle AKP is isosceles, AP is parallel to OE, and $EPO = OAP$. Now since $OFA = OAF$, FO is parallel to PE and $OFG = PCI$. But since $FO = CP$, CIP and FGO are equal right triangle and $IP = GO$, and the point P describes the cissoid according to the definition.

To obtain the equation of the cissoid, make $CE = AB = 2a$; $AH = x$; $PH = y$. Then, from the similar triangles AHP and AOL, we get

$$x : y :: a : OL.$$

But $OL = \frac{1}{2}CO = \frac{1}{2}[y + CI\,(= FG)] = \frac{1}{2}\{\, y + \sqrt{[(2a - x)x]} \,\}$;

$$\therefore x : y :: a : \tfrac{1}{2}\{\, y + \sqrt{[(2a - x)x]} \,\};$$

which gives $y^2 = \dfrac{x^3}{2a - x}$, the equation of the cissoid.